

Suggestions for Radiation Surveys

This is the order I would do things.

1. Aerial survey

- do not focus only on radium-226, think of other gamma emitters that might be related, might be in the background, might be interferences
- be sure to include a background survey, out of the area of concern
- if possible try to relate an aerial measurement to an exposure rate or a soil concentration measured on the ground
- be aware that aerial surveys are averages over large circles so that hot spots may be obscured.
- be sensitive to irregularities in the shape of hot spot patterns. Irregularities in the pattern may indicate hot spots.

2. Scan Van

- scan areas covered by aerial survey with the intent of confirming hot spots found from the air and catching additional hot spots.
- the scan van works best in open lands. We have not been able to use it in metropolitan areas because of NORM interferences from building facades.

3. Create a reference source

- based on the radionuclide(s) in the cleanup criterion, create a physical standard that all surveillance personnel can use to (1) establish a common reference and (2) establish a correspondence of count rate to concentration.

4. Create a cleanup criterion and a field correspondence

- First create a cleanup criterion. Then with the reference source, determine what meter count rate corresponds to this criterion. Use this in the field for rapid surveillance. This level might be reduced some to ensure there is a margin of safety. This correspondence is wonderful for rapid determinations in the field but soil concentrations should be relied on for the final determinations.



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5. Establish a NUTRANL site

- NUTRANL provides a rapid assessment of the radium-226 concentration in a soil sample (about 20 minutes for a 20 ml sample). This will be invaluable for site surveillance and for verifications.

6. Establish a correspondence record between NUTRANL and fixed lab results.

7. Select a fixed lab for official verification determinations.

- NUTRANL is fine for field surveillance, but the official verification should be through a fixed lab.

- set the gamma lines to be used for verification. The 186 keV line is not good because radium-226 and uranium-235 are inseparable at this energy.

- set the hold time for verifications so that radium-226 is in equilibrium with its daughters. Then lead-214 and/or bismuth-214 can be used for concentration measurements. If the hold time is too short, the lead-214 / bismuth-214 concentrations will be under estimates.

- establish a relationship between radium-226 by gamma spec and radium-226 by emanation. Emanation is the best but it takes a long time and is more labor intensive. There may be quite a difference in concentration results.

8. Gamma scan open lands with real-time GPS or real-time laser

- Region 5 has used GPS with gamma survey meters (2x2 NaI or FIDLER) to produce color-coded maps. These are invaluable to locate areas for further investigation and/or corrective action. Region 5 has developed this for instant, real-time, wireless analysis so that field surveys can be done with instant results. A jogger's baby carriage is very useful to carry all instruments over large areas.

- by experience, the FIDLER is better able to find NORM contaminants than the 2 x 2 NaI

- by experience, a count rate meter is far better than an exposure rate meter for property surveillance.

- do not rely only on count rate only. The pattern of count rate is extremely important because buried deposits may only be seen by small changes in count rate.

- be cognizant of response time. Surveillance staff should not sprint across a property because elevated count rates may not be detected if passed too quickly.

- Region 5 has had Argonne develop a similar laser system that can be used when GPS satellites are not accessible.

9. Gamma scan inside buildings with real-time instruments

- The laser system was originally developed for interior surveys of walls, floors, table tops, etc. It will do inside what GPS does outside.

10. Do radon measurements inside buildings with EPERMS.

- These monitors give readings you can do yourself. They are instantaneous and you are in control of the placements and the readings. Rad-Elec will give you software for immediate calculation of concentrations.

- Be sure to look for radon-220. It might be there and it carries about 1/3 the dose of an equal concentration of radon-222.

11. Not all cleanups have to be by excavation

- Region 5 has recently had 2 Fellows produce a bibliography on using plants, bacteria, shellfish, etc. to remove radionuclides. One of the Fellows is a professor at Spelman College in Atlanta, who could be a nearby resource.